ALTERATION OF SEDIMENTARY CLASTS IN MARTIAN METEORITE NORTHWEST AFRICA 7034.

F.M. McCubbin[1], R. Tartèse[2], A.R. Santos[1], G. Domokos[3], N. Muttik[1], T. Szabó[3], J. Vazquez[4,5], J.W. Boyce[6], L.P. Keller[7], D.J. Jerolmack[8], M. Anand[2,9], D.E. Moser[10], T. Delhaye[11], C.K. Shearer[1], C.B. Agee[1] [1]Institute of Meteoritics, University of New Mexico, Albuquerque, NM, 87131, USA. (E-mail: fmccubbi @unm.edu.[2]Planetary and Space Sciences, The Open University, Milton Keynes, MK7 6AA, UK. [3]Department of Mechanics, Materials and Structures, Budapest University of Technology and Economics, Budapest, Hungary. [4]United States Geological Survey, Menlo Park, CA 94025, USA. [5]Stanford-USGS Ion Microprobe Laboratory, Stanford University, CA 94305, USA. [6]Department of Earth and Space Sciences, University of California, Los Angeles, California 90095-1567, USA. [7]NASA Johnson Space Center, Houston, Texas 77058, USA. [8]Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia, PA 19104, USA. [9]Department of Earth Sciences, The Natural History Museum, London, SW7 5BD, UK. [10]Department of Earth Sciences, University of Western Ontario, London, Ontario N6A 5B7, Canada. [11]Plateforme ONIS/NanoSIMS, Université de Rennes 1, 35042 Rennes Cedex, France.

Introduction: The martian meteorite Northwest Africa (NWA) 7034 and pairings represent the first brecciated hand sample available for study from the martian surface [1]. Detailed investigations of NWA 7034 have revealed substantial lithologic diversity among the clasts [2-3], making NWA 7034 a polymict breccia. NWA 7034 consists of igneous clasts, impact-melt clasts, and "sedimentary" clasts represented by prior generations of brecciated material. In the present study we conduct a detailed textural and geochemical analysis of the sedimentary clasts.

Results/Discussion: Clasts with non-igneous textures in NWA 7034 are grouped under the term brecciated lithic clasts. These clasts typically consist of fine grained matrix surrounding coarser mineral fragments or other clast types (e.g., igneous clasts). This texture is typical of breccias, and they likely represent fragments of a breccia lithology that existed prior to the assembly and lithification of NWA 7034. The matrix and grain boundaries are distinct from the interconnected bulk matrix material, allowing the clasts to be distinguished from other clast types. Brecciated lithic clasts tend to be larger than igneous clasts, ranging in size from 0.9x0.2 mm to 11x12 mm. Quantitative shape analysis of the lithic clasts provide evidence of transport across the martian surface, although the transport mechanism cannot be determined. Some of the lithic clasts display evidence of secondary alteration, including Fe-oxide veining that cross cuts grains within the clast and terminate at the clast boundary. In addition, highly metamict zircons display elevated abundances of alkalis and LREE, consistent with alteration by crustal fluids similar in composition to the fluids implicated in high-temperature alteration of the nakhlite-chassignite magma body [4-5]. The bulk matrix of NWA 7034 does not exhibit evidence of interaction with the same crustal fluids. U-Pb ages of alkali-rich metamict zircons from an altered sedimentary clast in NWA 7034 yield concordant ages of 1574±38 Ma, which likely reflects a minimum age of alteration and may reflect a reset age of the zircon.

References: [1] Agee et al., (2013) *Science*, 339, 780-785. [2] Humayun et al., (2013) *Nature*, 503, 513-516. [3] Santos et al., (2014) *LPSC*, 2621. [4] McCubbin et al., (2009) *GCA*, 73, 4907-4917. [5] McCubbin et al., (2013) *MAPS*, 48, 819-853.